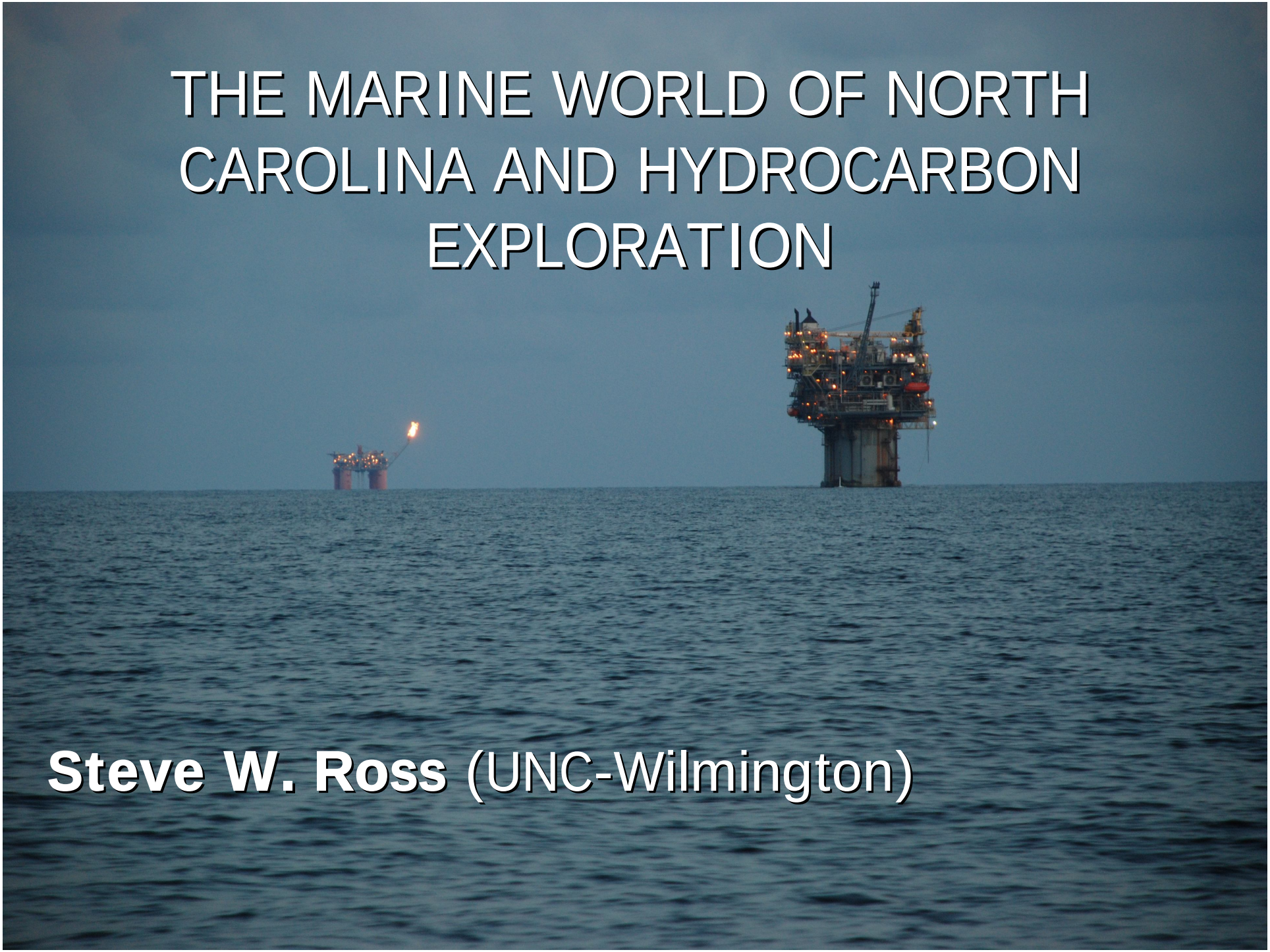
THE MARINE WORLD OF NORTH CAROLINA AND HYDROCARBON EXPLORATION



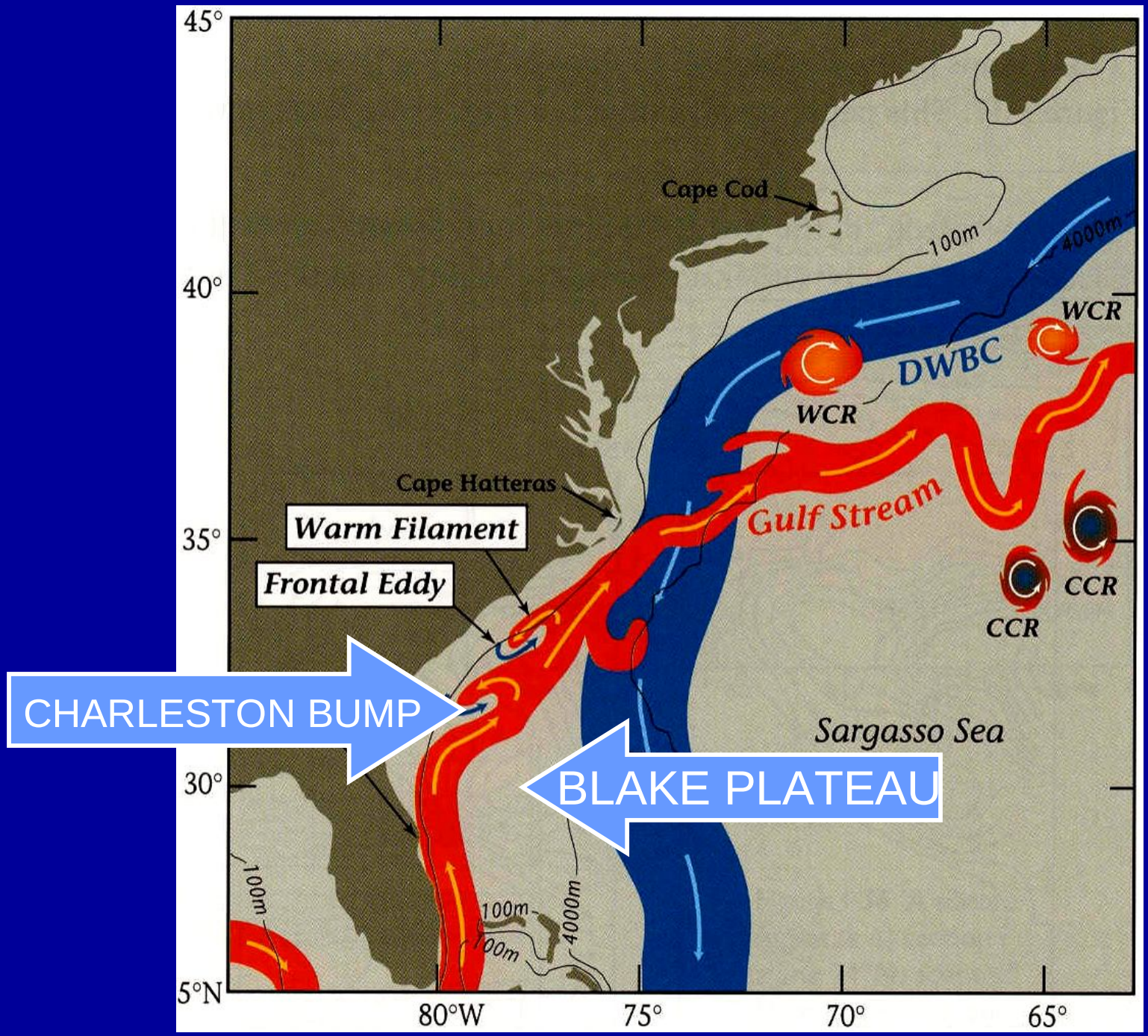
Steve W. Ross (UNC-Wilmington)

North Carolina Marine Ecosystems

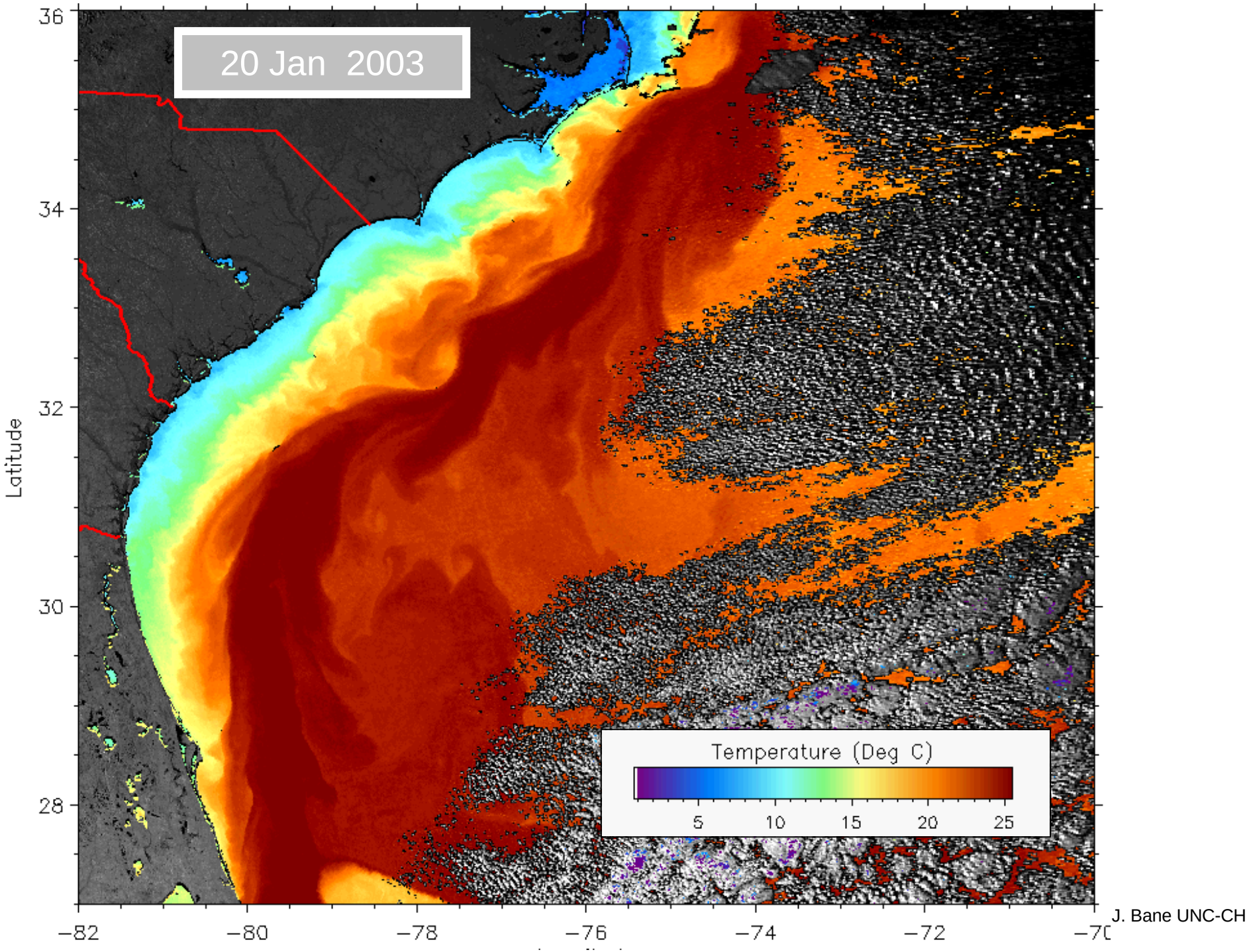
- **Large estuaries and numerous rivers**
- **Long coastlines, inshore and offshore**
- **Extremely high marine and estuarine biodiversity**

  (> 800 spp. of fishes, more than anywhere else in US except FL)

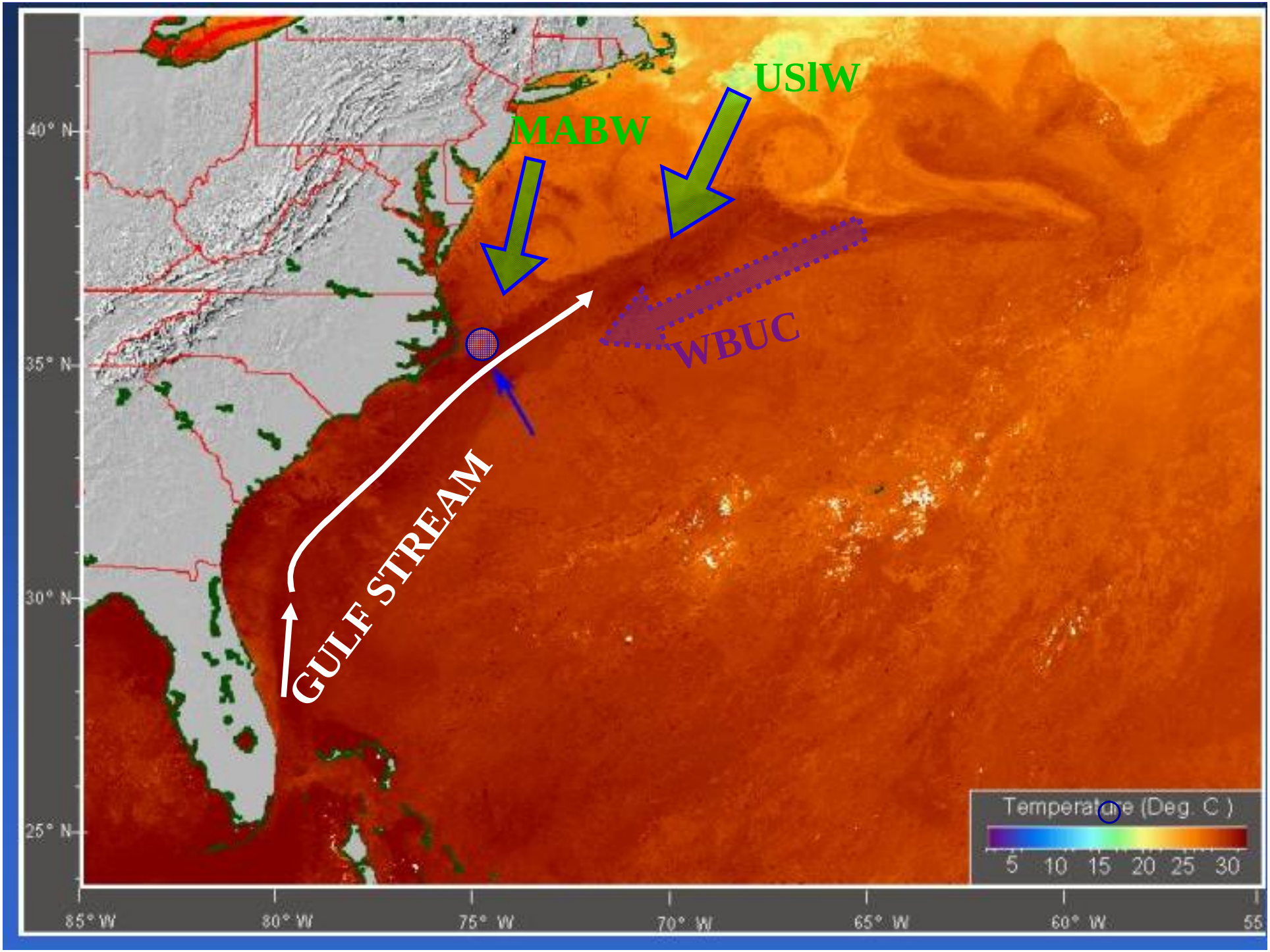
  - ❖**Moderate climate**
  - ❖**Temperate latitudes**
  - ❖**Habitat diversity high**
  - ❖**Gulf Stream**


45°
40°
35°
30°
5°N
80°W
75°
70°
65°
Cape Cod
100m
4000m
WCR
DWBC
WCR
Cape Hatteras
Warm Filament
Frontal Eddy
Gulf Stream
CCR
CCR
CHARLESTON BUMP
Sargasso Sea
BLAKE PLATEAU
100m
100m
100m
4000m

[J. *Bane*, 1994]


20 Jan 2003
Temperature (Deg C)
5
10
15
20
25
Latitude
36
34
32
30
28
−82
−80
−78
−76
−74
−72
−70

J. Bane UNC-CH


USlW
MABW
WBUC
GULF STREAM
40° N
35° N
30° N
25° N
85° W
80° W
75° W
70° W
65° W
60° W
55
Temperature (Deg. C)
5 10 15 20 25 30

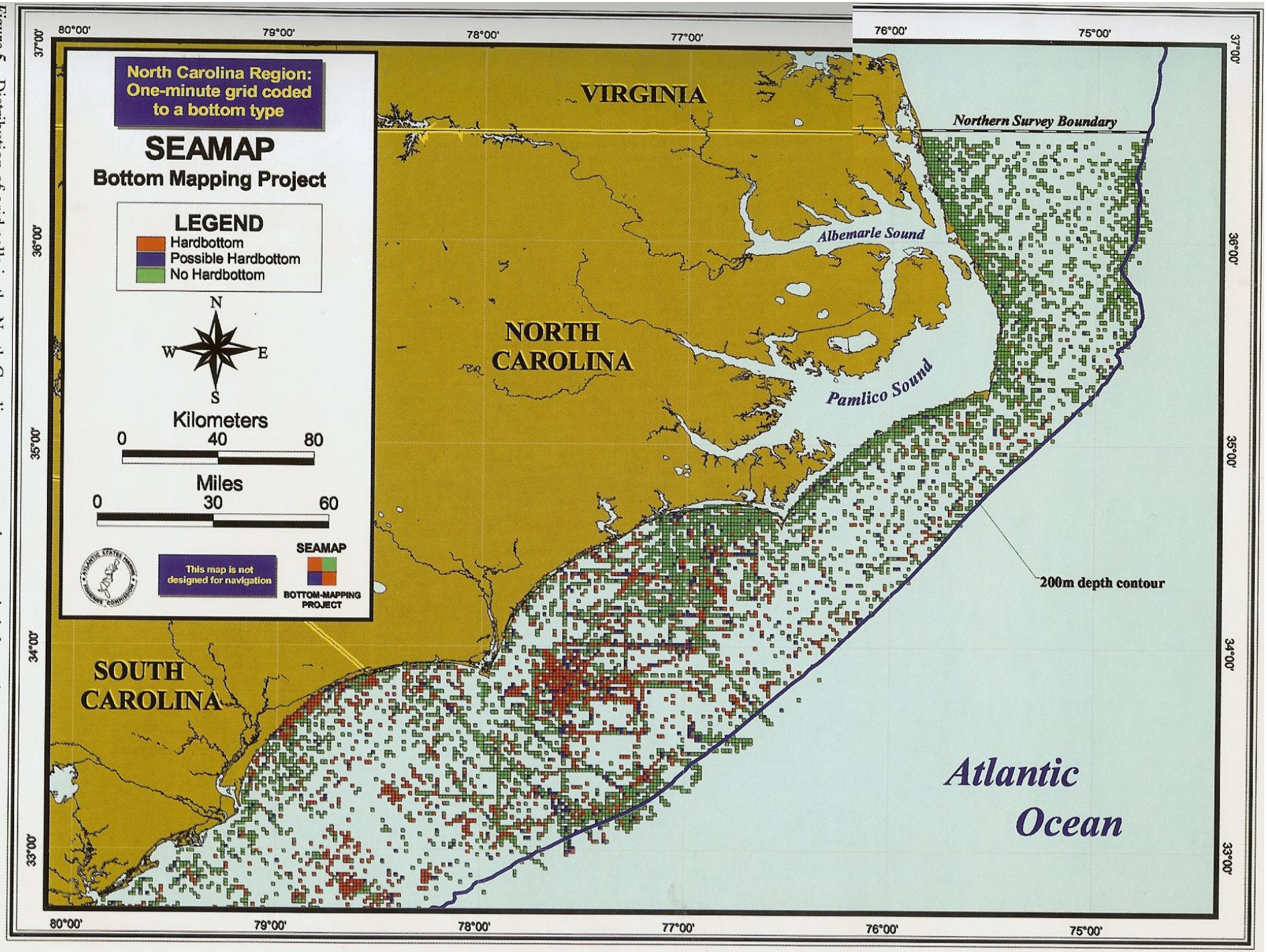
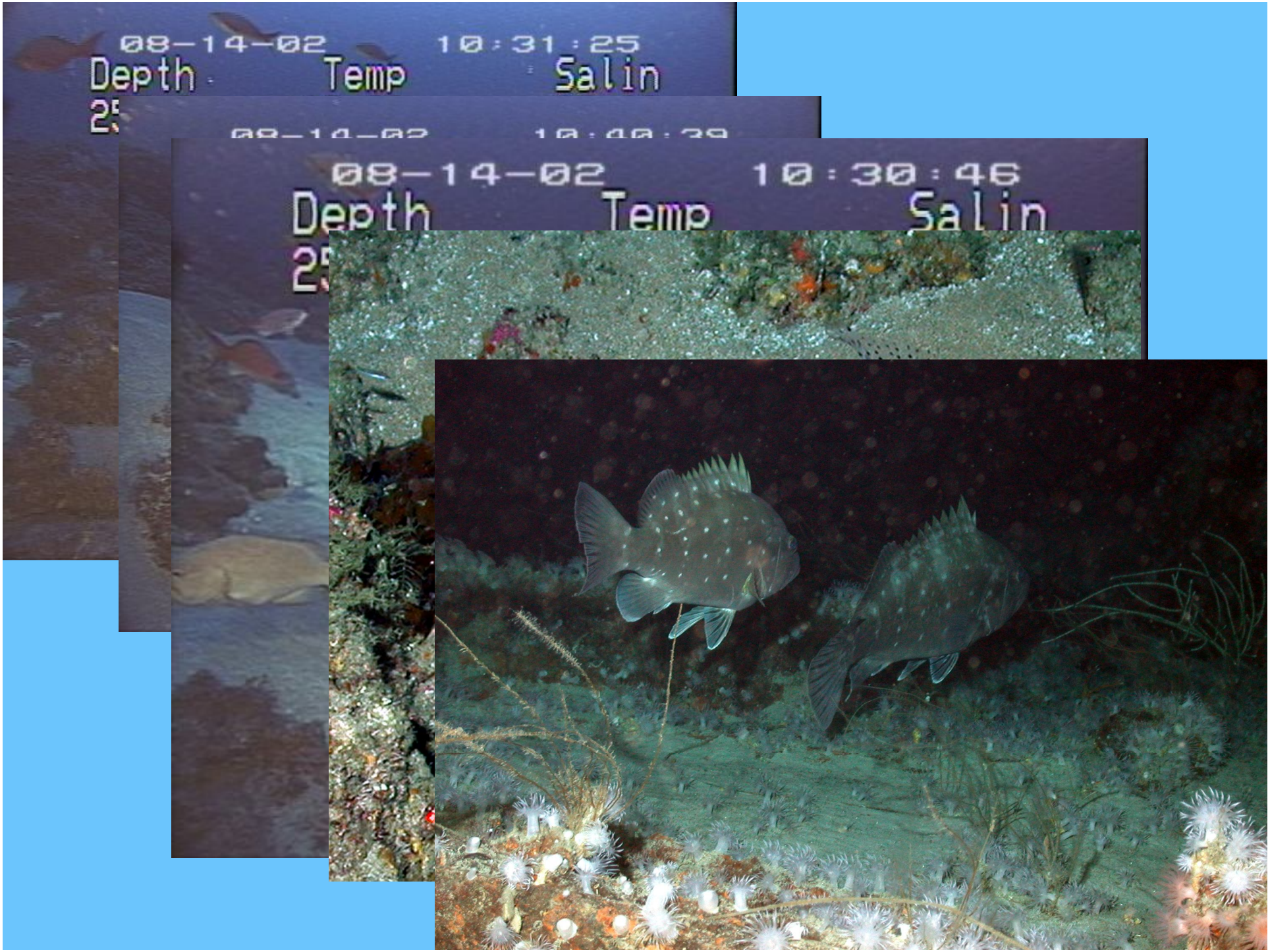


Figure 5 Distribution of grid cells in the North Carolina survey area that contain information on bottom type.

Major Soft Bottom Resources of Concern in NC

- Finfishes (flounders, spot, croaker, menhaden, seatrouts, seamullets). These dominate the landings and most are offshore winter spawners that use estuarine nurseries.
- Crustaceans (crabs, shrimps)
- Molluscs (scallops, clams, whelks, oysters?)

The biggest issue facing these resources is degraded habitat (upland sources) and overfishing (by catch issues).

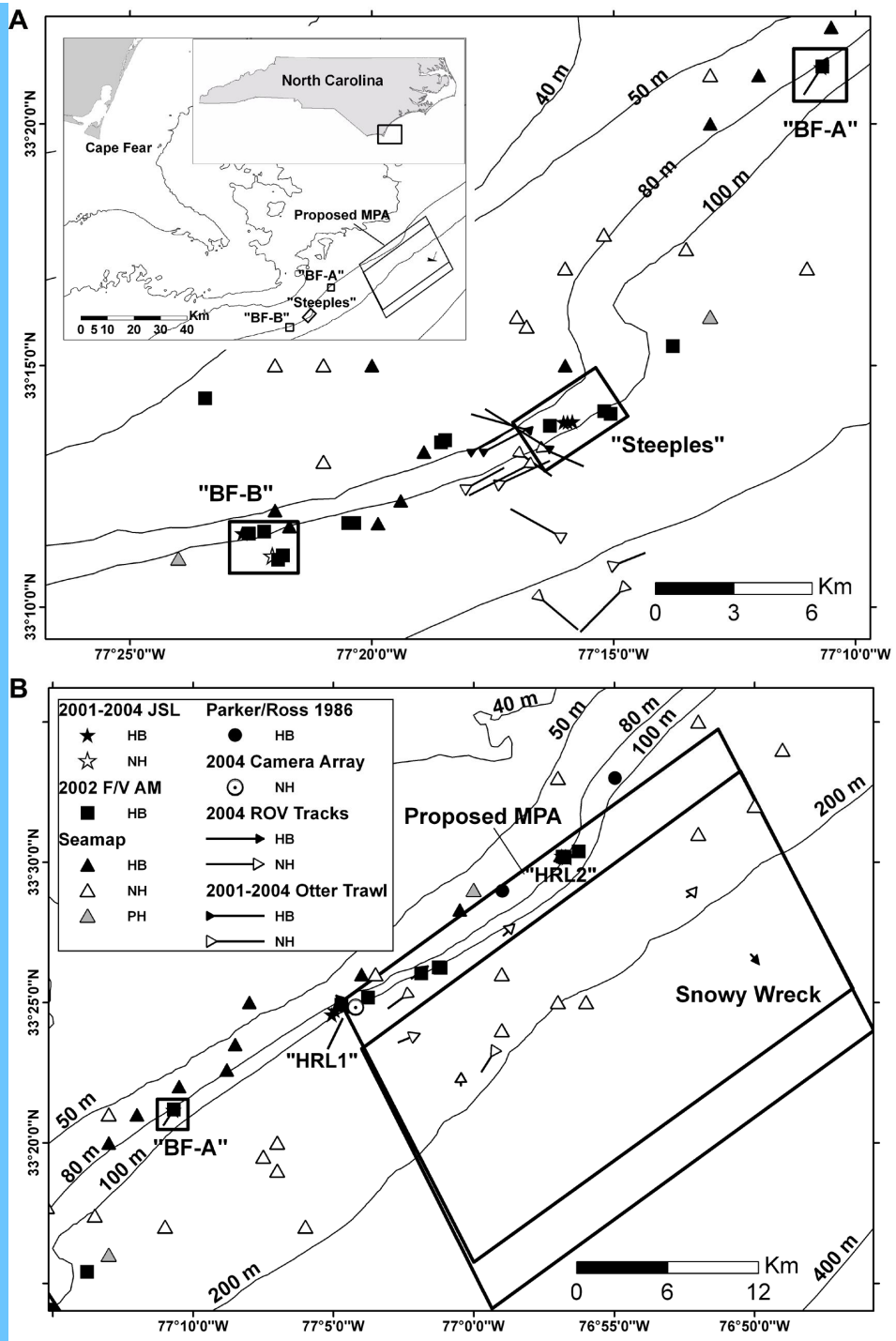

08-14-02 10:31:25
Depth Temp Salin
08-14-02 10:30:46
Depth Temp Salin

Major Hard Bottom Resources of Concern in NC

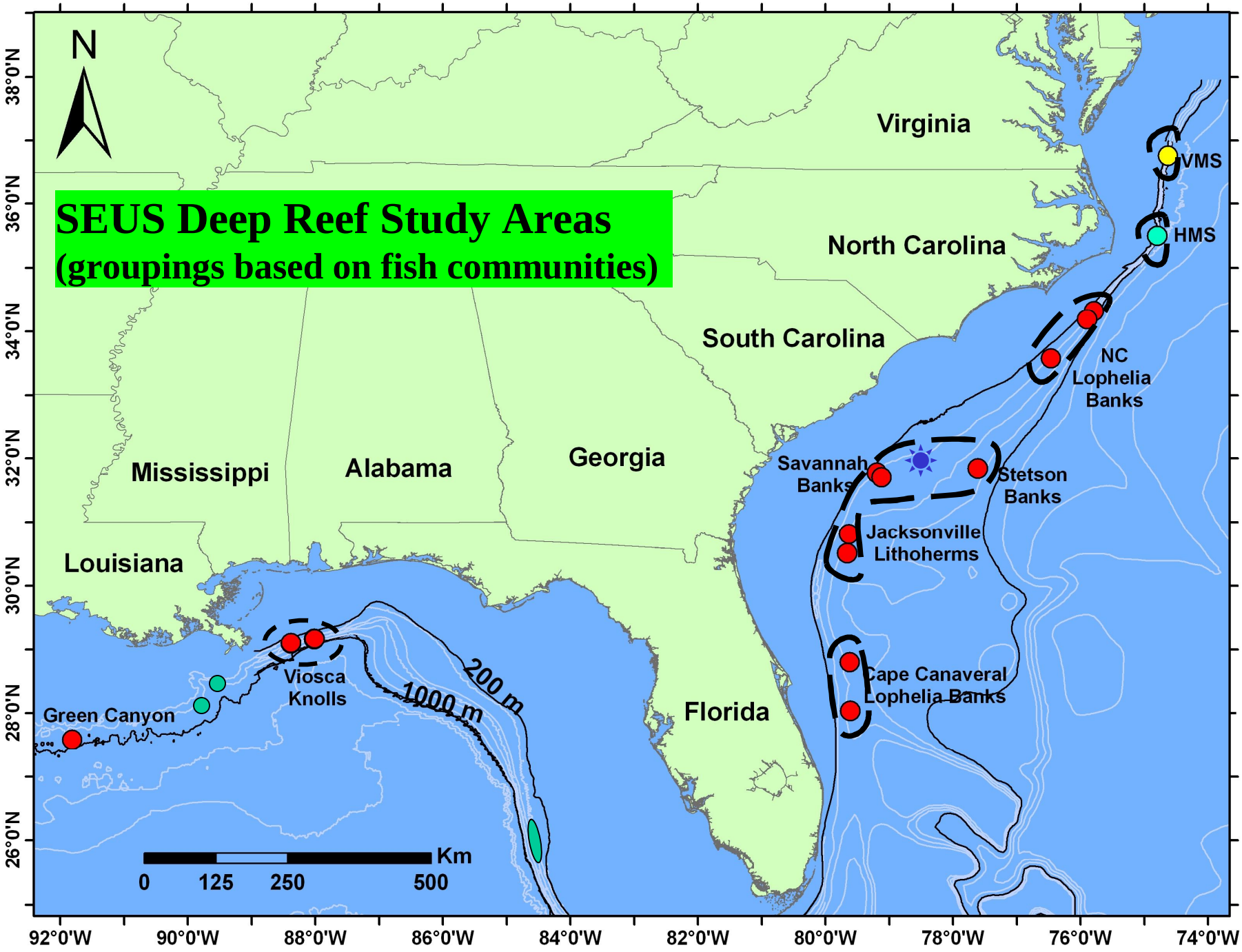
- Finfishes (snapper, grouper, porgy complex)
- Crustaceans (lobsters?)
- Molluscs?

The biggest issue facing these resources appears to be overfishing. Degradation of inshore juvenile habitats may also be of concern.

SAFMC has now designated MPAs along the outer shelf of the SEUS to protect snapper-grouper resources. One is located off NC. Do they protect the resource? How will or can that be determined?



Quattrini and Ross (2006)

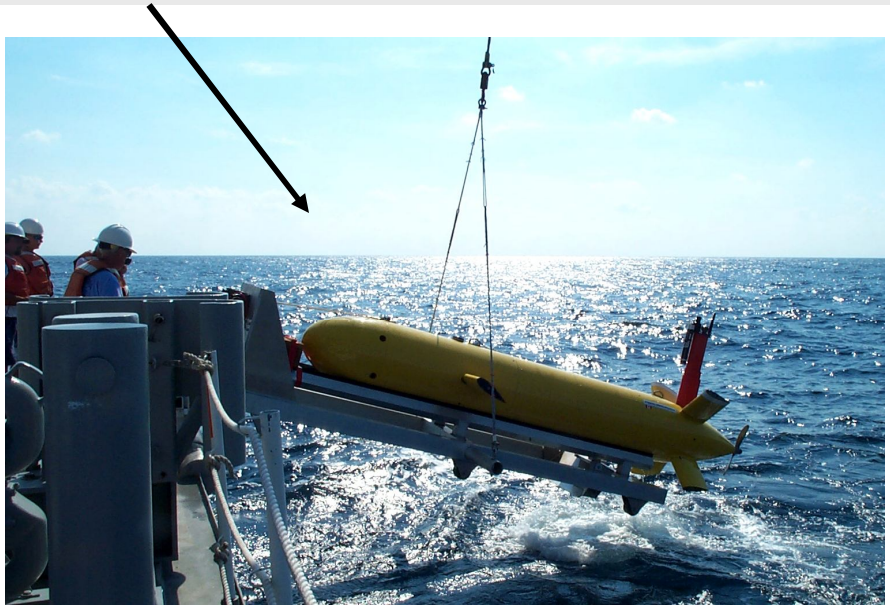

N
SEUS Deep Reef Study Areas
(groupings based on fish communities)
Virginia
North Carolina
South Carolina
Georgia
Florida
Alabama
Mississippi
Louisiana
VMS
HMS
NC
Lophelia
Banks
Savannah
Banks
Stetson
Banks
Jacksonville
Lithoherms
Cape Canaveral
Lophelia Banks
Viosca
Knolls
Green Canyon
200 m
1000 m
Km
0
125
250
500
38°0'N
36°0'N
34°0'N
32°0'N
30°0'N
28°0'N
26°0'N
92°0'W
90°0'W
88°0'W
86°0'W
84°0'W
82°0'W
80°0'W
78°0'W
76°0'W
74°0'W

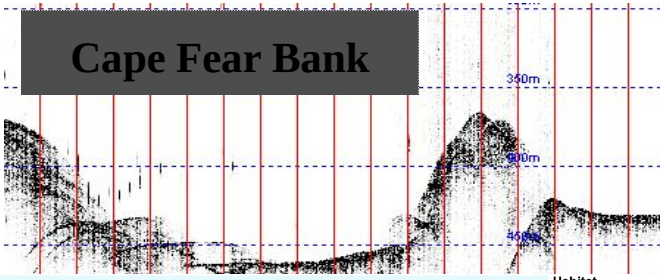
Mapping Results

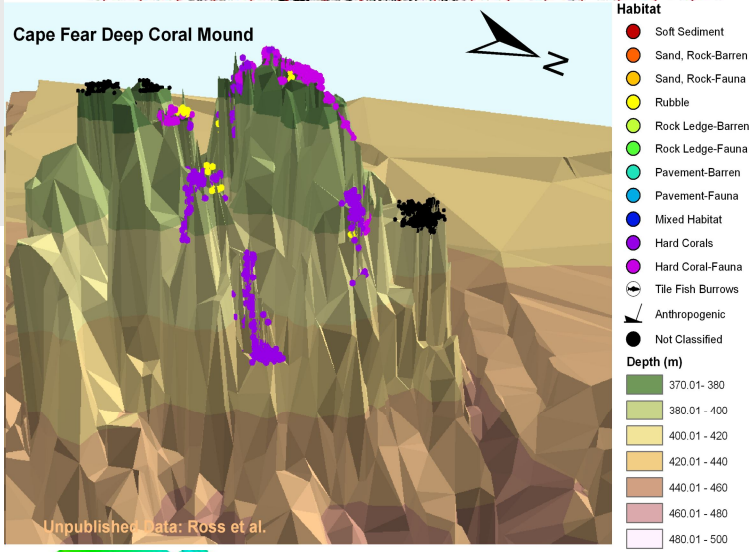
Single beam soundings available for our 8 study sites & other parts of SEUS.

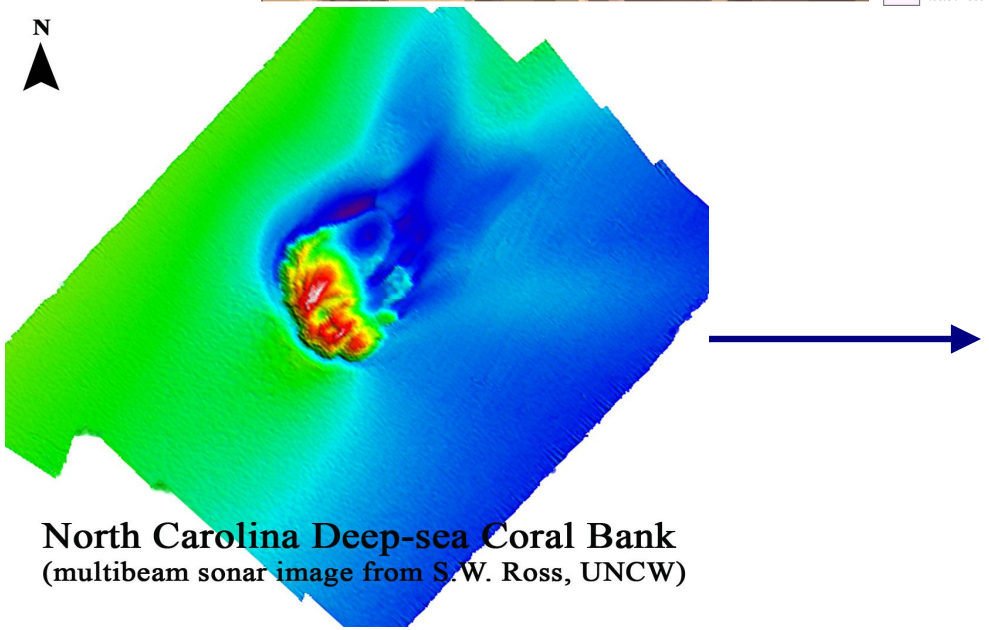
Multibeam data needed

- Ross cruise end of Oct 2006 – NC & Stetson sites.
- AUV work to add detail in selected areas



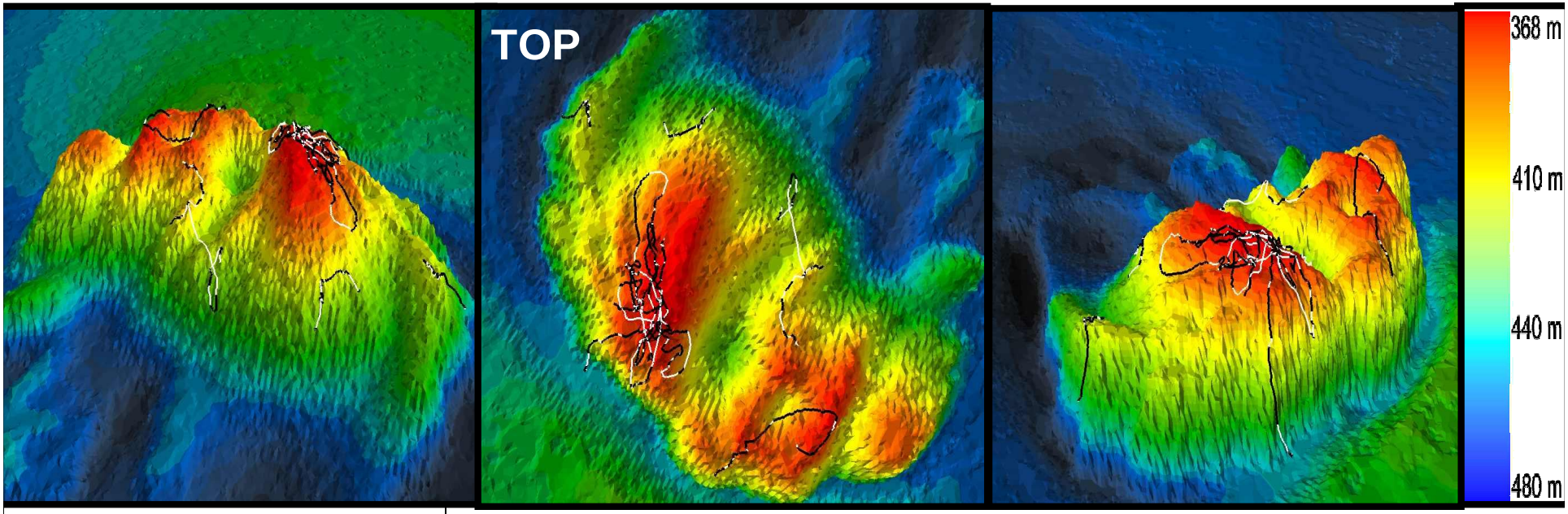






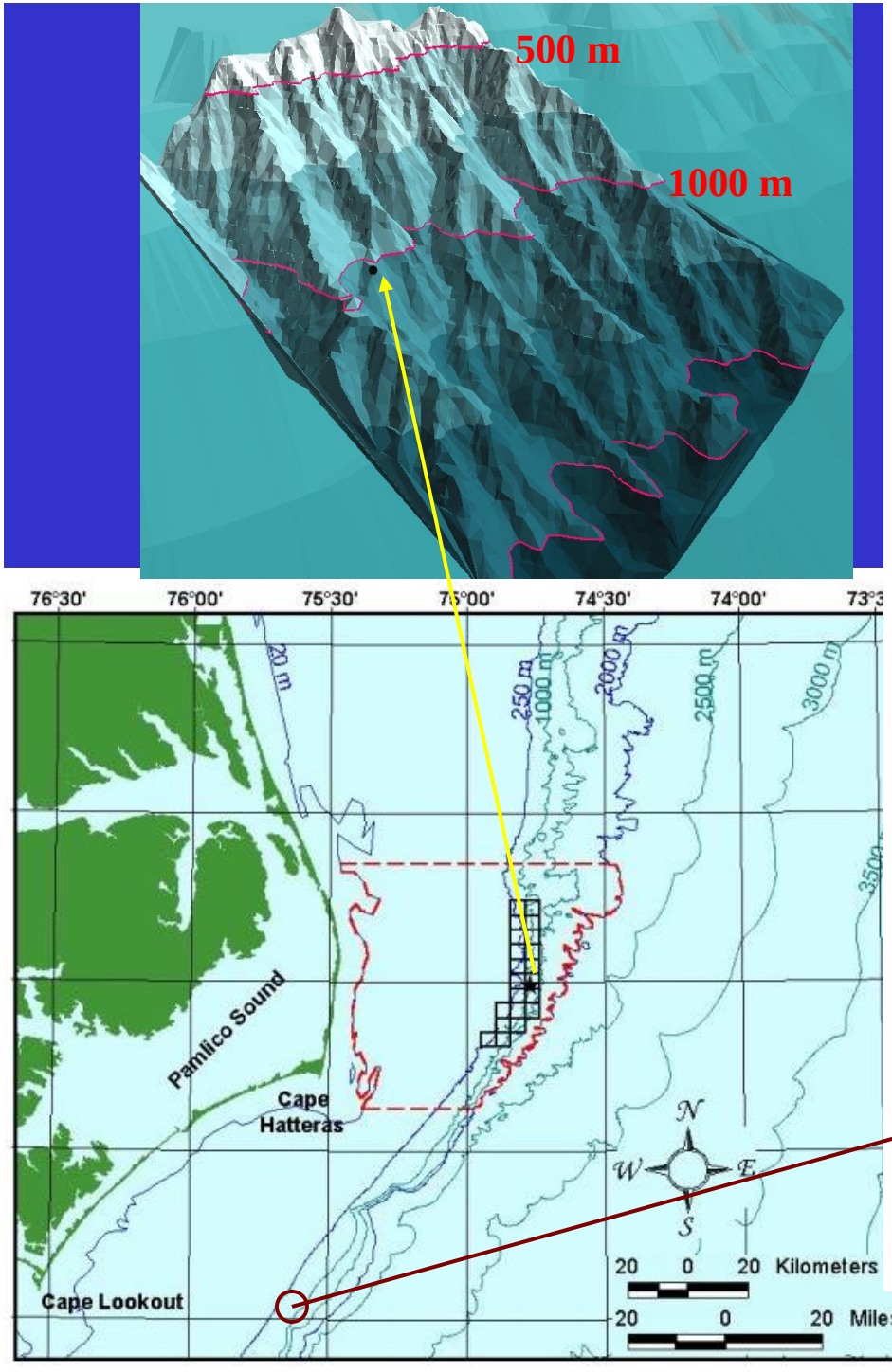
North Carolina Deep-sea Coral Bank
(multibeam sonar image from S.W. Ross, UNCW)

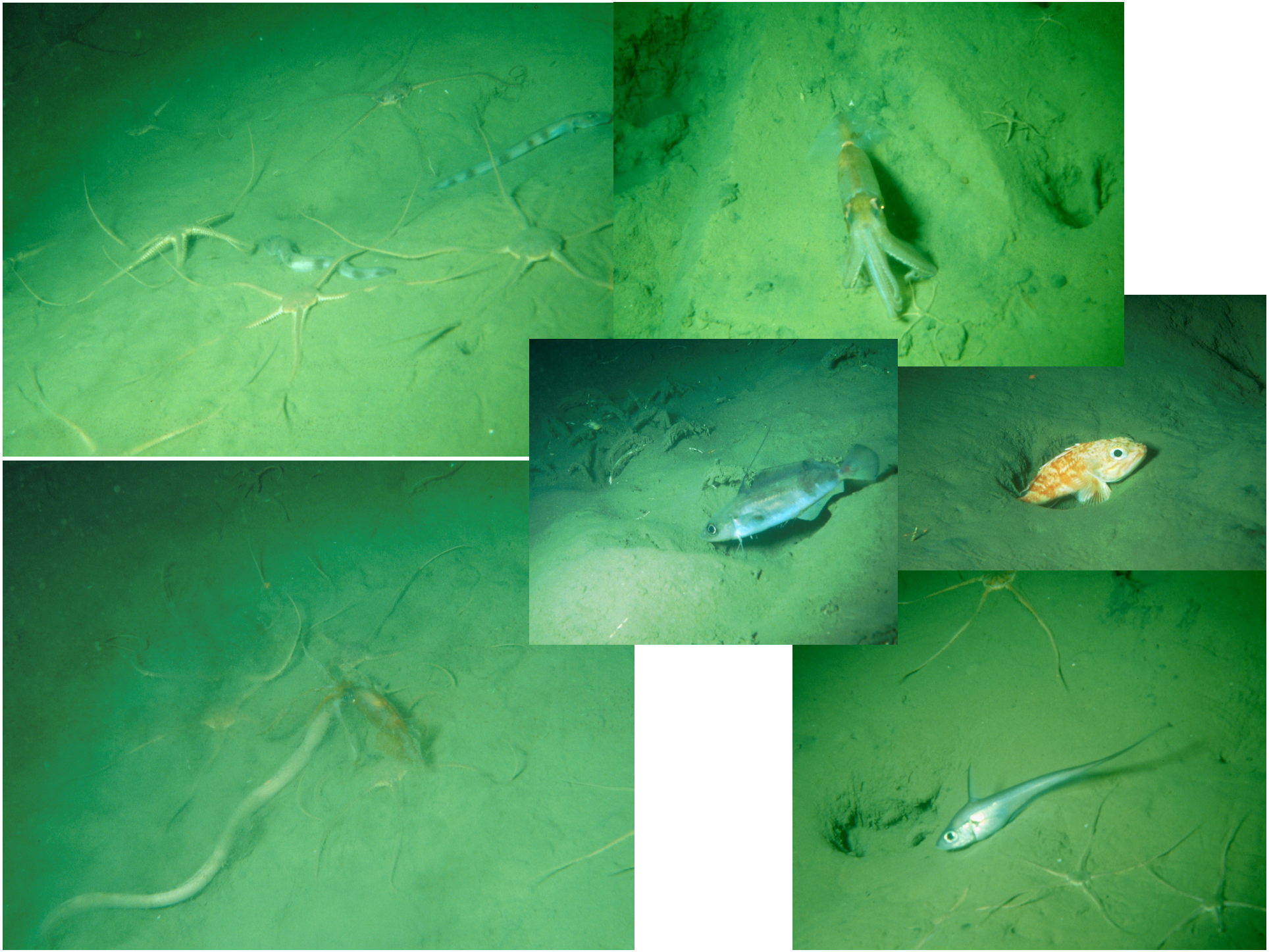
Cape Fear coral mound – multibeam sonar data
3-D view with overlay of JSL sub tracks (9 dives)



NORTHEAST FACING SLOPE

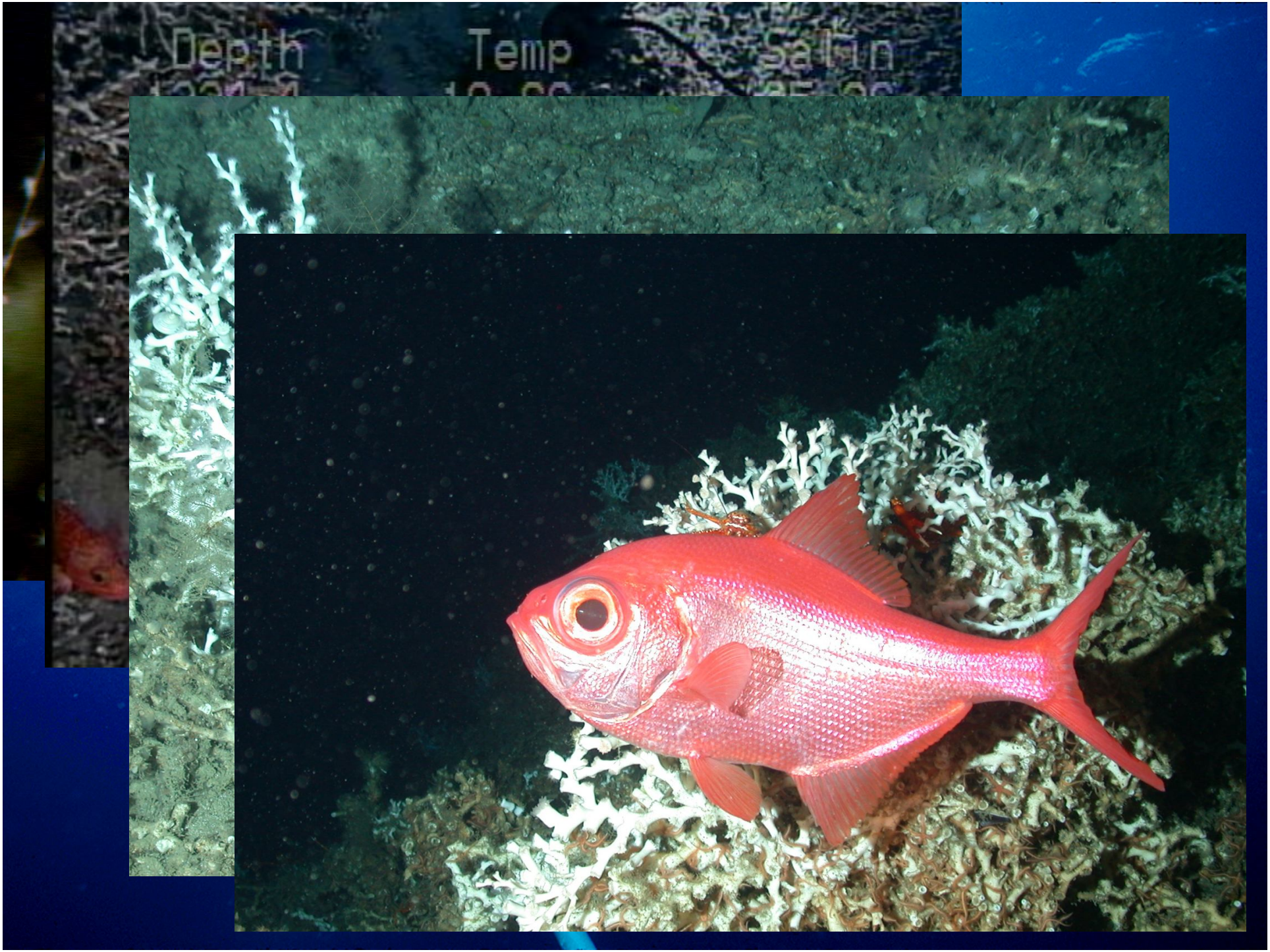
WEST FACING SLOPE


500 m
1000 m
76°30'
76°00'
75°30'
75°00'
74°30'
74°00'
73°3
20 m
250 m
1000 m
2000 m
2500 m
3000 m
3500
Pamlico Sound
Cape
Hatteras
Cape Lookout
N
W
E
S
20 0 20 Kilometers
20 0 20 Miles
34°30'
Cape Lookout Lophelia
Steve W. Ross - Unpublished Data - Do Not Use Without Permission
Proposed Deep Coral HAPCs
Km
0 3 6 12
34°28'0"N
34°24'0"N
34°20'0"N
34°16'0"N
34°12'0"N
34°8'0"N
75°54'0"W
75°50'0"W
75°46'0"W
75°42'0"W
Bathymetry (m)
390
510



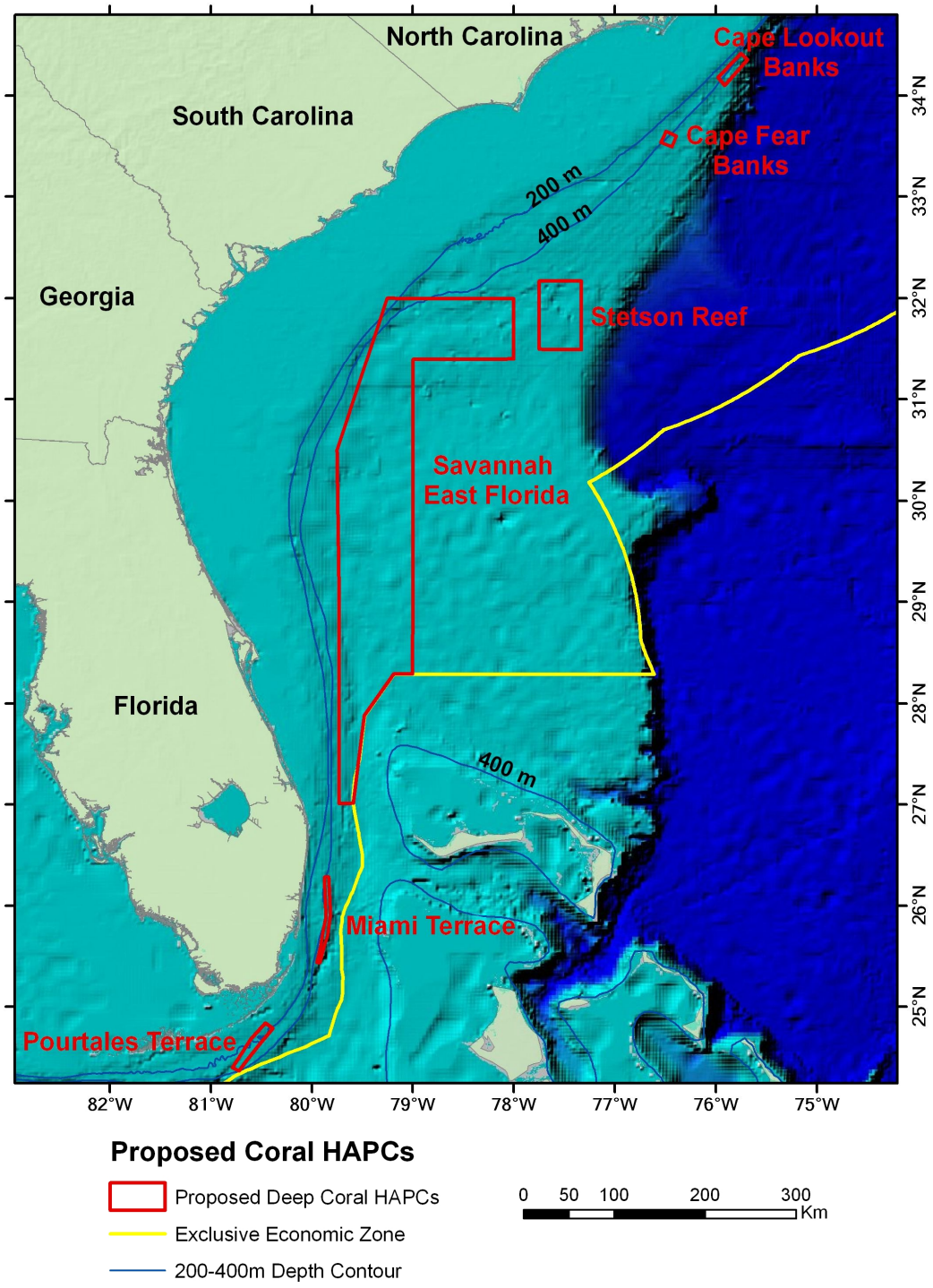
THE POINT AREA

- Dynamic, variable currents, upwelling present, but
- Below 200m region of no net motion
- Nepheloid layer present
- Rugged topography, mud canyons
- High organic deposition to the bottom
- Very high infaunal biomass
- Great abundance of macrofauna, but low species richness
- Abnormally small size structure in fish community
- Great productivity and biological activity in surface waters


Depth
Temp
Salin

Deep-sea Coral Habitats

- Heavily influenced by Gulf Stream dynamics, maybe unrealized small scale variability
- Banks widely scattered but more common on SEUS slope than thought
- Extremely rugged topography
- High species richness, high numbers of species new to science
- Provide shelter, feeding areas, and possibly spawning areas to many species



Deep coral areas proposed for protection by the South Atlantic Fishery Management Council (based on Ross & Reed data)


At least 80 fish species use *Sargassum*
(Casazza & Ross 2008)

ENERGY EXPLORATION ISSUES

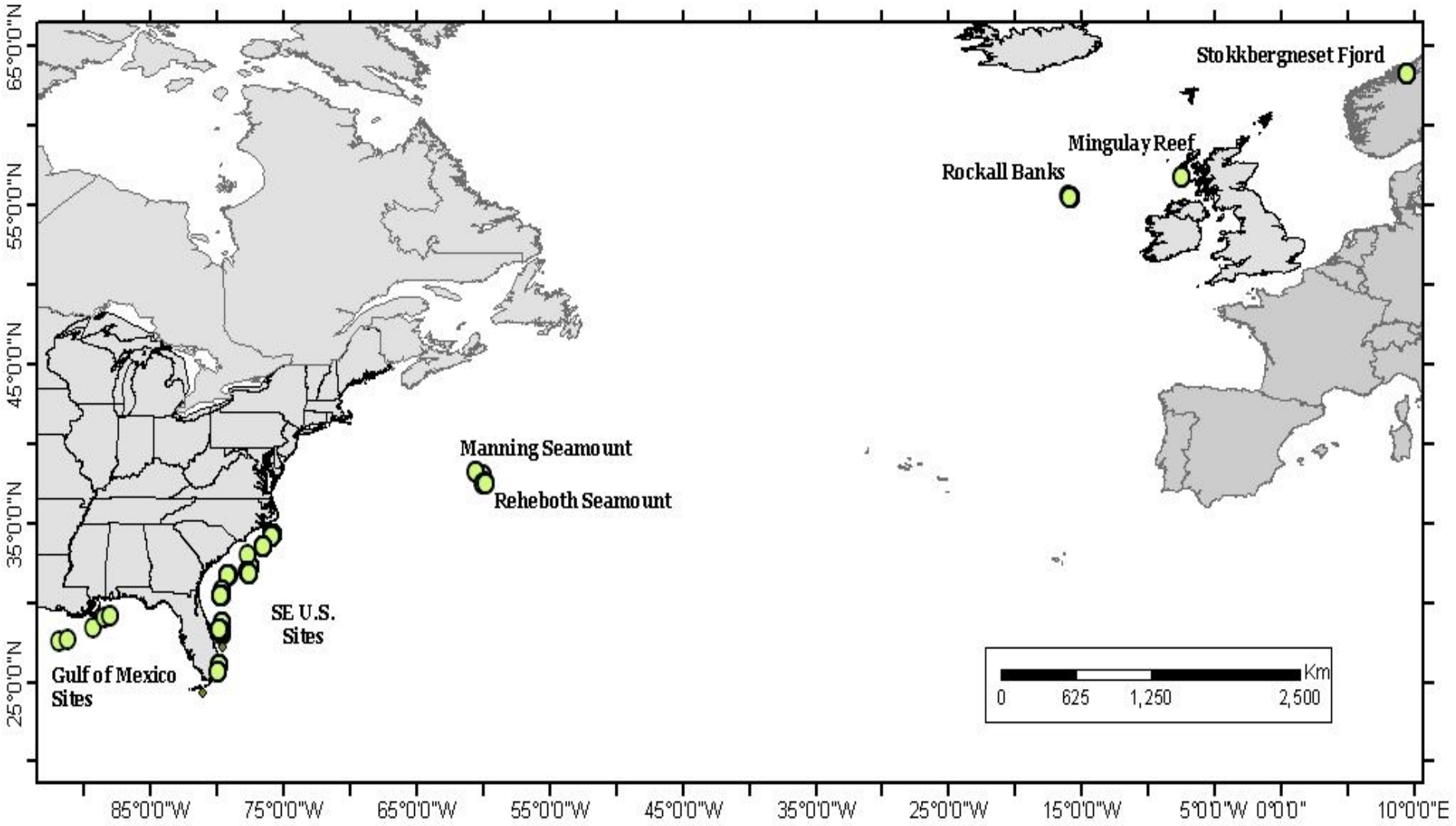
- Storms, currents, geology (slumps)
- Spills (location & timing)
- Sensitive habitats (estuarine nurseries, shelf hardgrounds, deep-sea corals, spawning grounds)
- Endangered/threatened species (1 fish, sea turtles, marine mammals, seabirds)

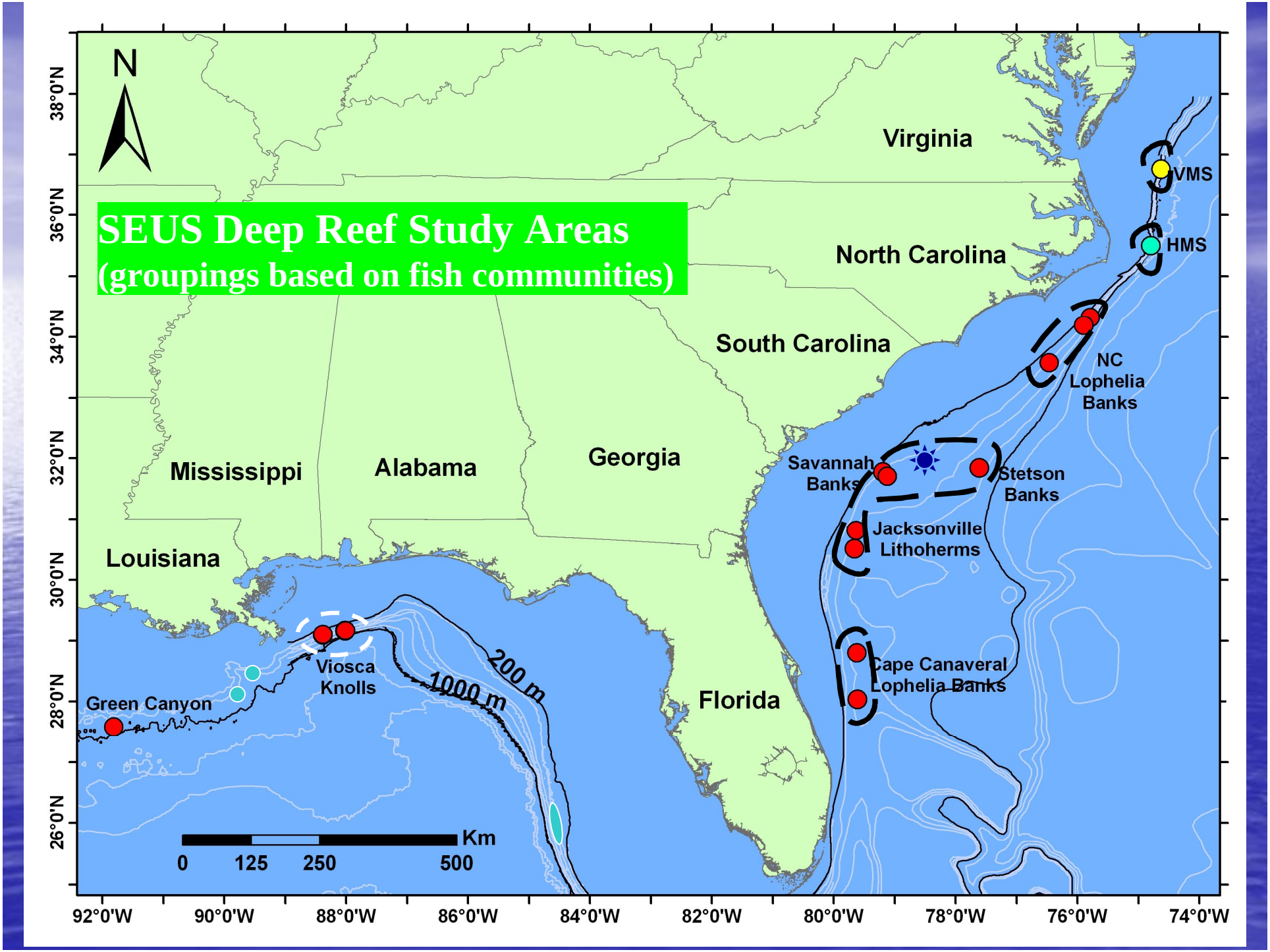
STUDIES TO CONSIDER

- Severe lack of biological data > 200 m
- Multibeam mapping of interest/target areas
  - Strong need for better habitat descriptions
- Trophodynamic studies
  - Complete study started at “The Point”, add other locations
- Interaction of physical oceanography and biology
  - larval transport, genetic continuity, dispersal barriers or conduits
- Population structure & connectivity studies
- Marine larvae dynamics
  - distributions, seasonality, movements
- Locate ocean spawning areas for important species
- Sociological/economic impact studies

Locations of Genetic Samples of Deep-water Coral (Lophelia pertusa)

Morrison, Ross et al. (in review)

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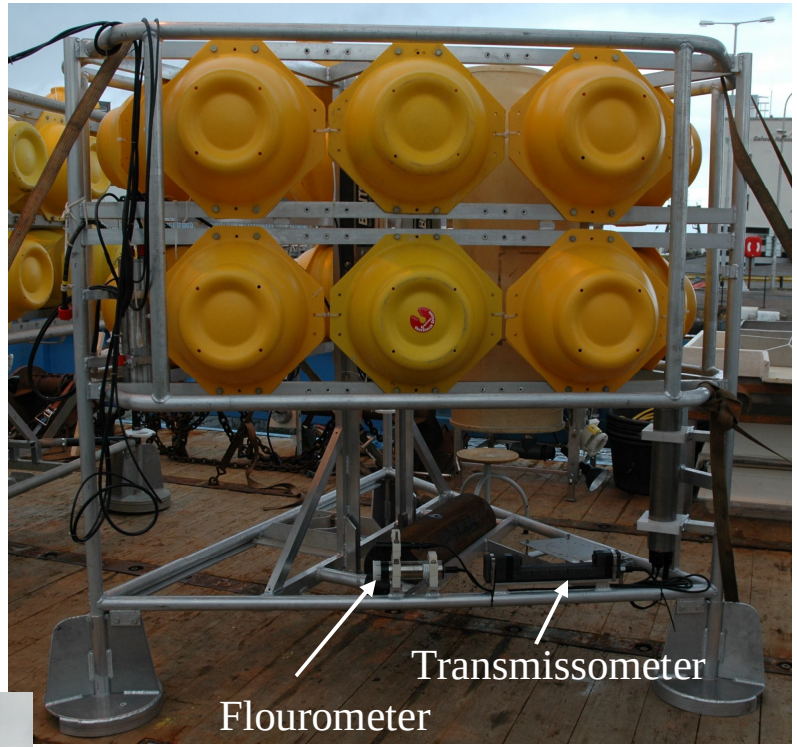
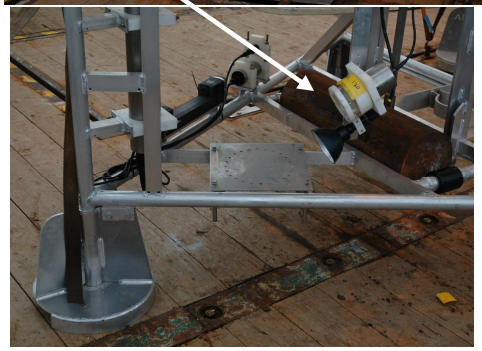
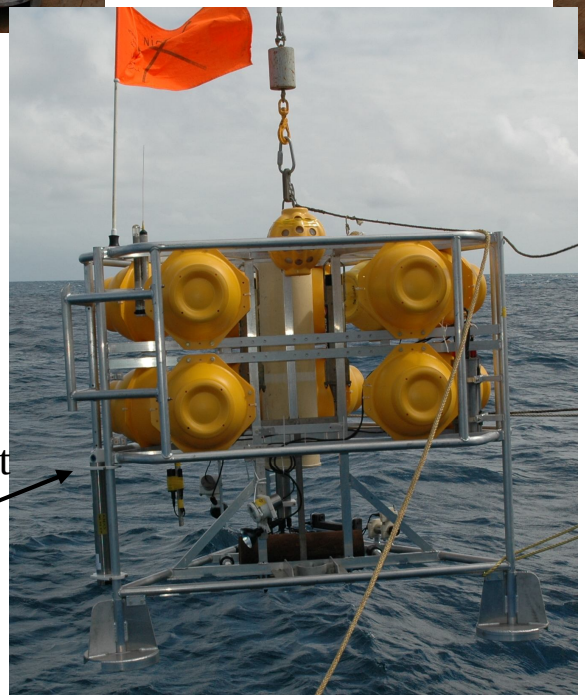
Lophelia
Banks
Savannah
Banks
Stetson
Banks
Jacksonville
Lithoherms
Cape Canaveral
Lophelia Banks
Viosca
Knolls
Green Canyon
200 m
1000 m
Km
0
125
250
500
38°0'N
36°0'N
34°0'N
32°0'N
30°0'N
28°0'N
26°0'N
92°0'W
90°0'W
88°0'W
86°0'W
84°0'W
82°0'W
80°0'W
78°0'W
76°0'W
74°0'W

Dual Acoustic Releases
& Weight







ADCP Current
meter

NIOZ
ALBEX Landers

Instruments

ADCP (up & down looking)
Single plane ADCP with compass, tilt & temperature
CTD (temperature, salinity, pH, DO)
Still Camera
SIT Camera
Passive Acoustic Monitor
Settling Plate experiments
Traps possible

1200 kg (2646 lb) weight in air